UNGER
CONSTRUCTION CO.

Proof of Training

Print name: _____Signature: _____ Date: _____

Mold Remediation

Purpose

This policy describes the procedures to be followed and the precautions to be taken when performing mold remediation. The purpose of this policy is to provide information about: the potential health effects associated with mold exposure, engineering controls, administrative controls, work practices that prevent mold exposure and protect the health of employees/subcontractors/building occupants during mold remediation. This policy is closely linked to our Infection Control policy and our Water Intrusion policy.

This policy is a living document that is subject to change as more information becomes available and as development occurs and advancements are made.

Scope

This policy will apply to all work performed by employees and subcontractors including, but not limited to, the following activities: construction, installation, demolition, remodeling, relocation, refurbishment, testing and servicing or maintenance of equipment or machines and at other times when mold could be encountered. These guidelines are for mold damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, chemical or biological pollutants then our policy for gray water events must be followed. Refer to our Water Intrusion policy for additional PPE, containment and handling requirements.

Deviations

It is impractical to prescribe procedures for every mold remediation situation since every mold remediation project is unique. In certain circumstances experience and professional risk management judgement may justify deviation. Deviations shall be documented and approved in writing by senior management (one of the owner's of Unger Construction).

Responsibilities

Management

Management will monitor the effectiveness of the program, provide personal protective equipment as needed, provide training to affected employees and supervisors, provide technical assistance as needed and review the program annually.

Program Manager

Dave Simpson is responsible for the development, documentation, training and administration of the program. This position carries the responsibility of insuring this program is adhered to and that proper reporting is executed.

Supervisors (Superintendents and Foreman)

Supervisors are responsible for ensuring Unger Construction employees and subcontractors are following expectations. Supervisors will be held accountable for enforcing the requirements of this program. Undesirable behavior will not

resolve itself, therefore supervisors must be directly involved with modifying behaviors inconsistent with program expectations. Additionally, supervisors will be held accountable for enforcing Unger Construction's disciplinary program.

Workers

Unger Construction has high expectations and requires safety excellence for each employee, crew and construction project. Every employee and subcontractor must adhere to our safety policies, procedures and be in full compliance with applicable governmental laws, rules and regulations. Employees and subcontractors that choose to conduct themselves in a manner that is inconsistent with these expectations will be held accountable for those decisions and may incur disciplinary actions. All employees and subcontractors are required to follow the minimum procedures outlined in this program. Any deviations from this program must be immediately brought to the attention of your supervisor.

Training

Protecting the safety and health of employees/subcontractors and building occupants (hereafter referred to as remediators) is of paramount importance in mold remediation projects. Before any employee or subcontractor is allowed to perform work in areas that are known to contain or are suspected of containing mold, they must be trained. Physical, chemical, microbial hazard training shall include the following information: Health effects associated with mold, methods of recognizing/identifying mold, engineering controls, administrative controls, personal protective equipment and safe work practices. Each employee or subcontractor must demonstrate an understanding of the required training before being allowed to perform work. For Unger Construction, employee's proof of training is available on the "S" drive. Prior to starting work all subcontractors shall provide evidence of Mold Awareness training.

Retraining

The need for retraining will be indicated when an employee or subcontractors work habits or knowledge indicate a lack of necessary understanding, motivation or skills required to properly work within or around mold remediation.

Hazardous Material Survey

Unger Construction requires hazardous materials surveys before demolition or renovation work begins. The survey shall include all of the following: a visual inspection of a facility or a portion thereof for suspect materials and sampling and laboratory analysis of any suspect materials found for the presence of asbestos or lead. The survey will also furnish a written report that includes: a description of the area(s) visually inspected, a detailed description of any suspect material sampled, the results of any laboratory analysis of suspect materials, the method of analysis and the total amount of asbestos containing material. Typically a floor or roof plan is included with the report to reference the written information visually.

The person conducting the survey must be certified pursuant to OSHA and/or EPA regulations. The survey may be performed by a certified Site Surveillance Technician (SST) under the supervision of a licensed consultant. The survey needs to be kept in a project file so that it can be accessed when working on future projects.

If lead or asbestos have been confirmed to be present, employees and subcontractors must follow Unger Construction's Lead and/or Asbestos program. If hazards such as asbestos or lead will be disturbed during remediation, a properly licensed professional must perform the work and follow appropriate regulations.

Risk Management and Insurance

Category 3 water intrusion and mold remediation warrants prudent risk management to ensure our liability exposure is balanced with our business management practices. Depending on the circumstances, Unger Construction may choose to hire specialized experts that can carry appropriate business and environmental liability insurance. Unger Construction will decline work that is outside of our own expertise.

Client insurance policies covering structures subject to water damage or mold remediation are complex. The evaluation of insurance coverage for water damage or mold remediation has become much more uncertain and problematic. Payment for water damage and mold remediation services generally comes directly from the client rather than through an insurance company. General liability policies and most commercial liability policies could exclude some or all of the claims for injury or damage resulting from mold or pollutants including the cost of the cleanup.

Environmental insurance is the only insurance available to cover mold remediation. This specialized insurance coupled with proper planning can maximize the value of the insurance purchased while minimizing the premiums paid and the potential professional liability exposure. The market place includes only a small number of insurers capable of writing a full range of environmental coverage.

Mold Regulations

Mold is not regulated by Occupational Safety and Health Administration (OSHA), the Environmental Protection Agency (EPA), the Center for Disease Control (CDC) or National Institute for Occupational Safety and Health (NIOSH). No professional organizations have established threshold exposure limits. Historically, Unger Construction's action levels were based on the quantity or size of the visible mold growth area but this is no longer the case. Unger Construction's mold remediation program is based on American National Standard Institute (ANSI) and Institute of Inspection Cleaning and Restoration Certification (IICRC) standard S520-2015 "Standard for Professional Mold Remediation." ANSI/IICRC S520-2015 represents a shift away from using the "size" of visible growth to determine remediation response. Instead ANSI/IICRC S520-2015 establishes mold contamination definitions: Condition 1, Condition 2 and Condition 3, as guidance in determining remediation response.

Condition 1 – No remediation activity. (Normal Fungal Ecology) – an indoor environment that may have settled spores, fungal fragments or traces of actual growth whose identity, location and quantity are reflective of normal fungal ecology for a similar indoor environment.

Condition 2 (Settled Spores or Fungal Fragments) – An indoor environment which is primarily contaminated with settled spores or fungal fragments that were dispersed directly or indirectly from a Condition 3 area and which may have traces of actual growth.

Condition 3 (Actual Growth) – An indoor environment that is contaminated with actual mold growth (actual growth includes growth that is active, dormant, visible or hidden) or the presence of associated spores and fungal fragments.

Condition 4 - Not enough information to determine if Condition 2 or 3 exists.

Exclusions

Hazardous or Regulated Materials

The presence of hazardous or regulated materials such as lead or asbestos will present a limitation and complications. Lead and asbestos require specific training, licensing, permits, specific mitigation or remediation protocols. The presence of these hazardous or regulated materials takes precedence over the mold remediation and will necessitate engaging a qualified/specialized hazardous or regulated materials expert.

Heating Ventilation and Air Conditioning (HVAC) Systems

Mold Remediation of HVAC systems shall be excluded from Unger Construction's scope of work and shall be performed by a HVAC subcontractor. Ductwork with a non-porous surface responds well to cleaning and remediation. Sections of internally lined ductwork, duckboard or flexible ductwork that are Condition 3 cannot be successfully cleaned and therefore shall be replaced. When HVAC systems undergo remediation they should be inspected and retuned to Condition 1 per the National Air Duct Cleaners Association (NADCA) Standard "Assessment Cleaning and Restoration of HVAC Systems."

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Mold Basics

Molds are part of the natural environment. Molds are fungi that can be found anywhere - inside or outside - throughout the year. About 1,000 species of mold can be found in the United States, with more than 100,000 known species worldwide. Outdoors, molds play an important role in nature by breaking down organic matter such as toppled trees, fallen leaves and dead animals. We would not have food and medicines like cheese and penicillin without mold. Indoors, mold growth should be avoided. Problems may arise when mold starts eating away at materials, affecting the look, smell and possibly with the respect to wood-framed buildings, affecting the structural integrity.

Molds can grow on virtually any substance as long as three things exist 1) moisture 2) an organic source is present 3) temperature is within tolerance for the mold species. Molds can be dormant, active, visible or hidden. Molds reproduce by creating tiny spores (viable seeds) that usually cannot be seen without magnification. Mold spores continually float through the indoor and outdoor air. Molds are usually not a problem unless mold spores land on a damp spot and begin growing. They digest whatever they land on in order to survive. There are molds that grow on wood, paper, carpet, foods and insulation, while other molds feast on the everyday dust and dirt that gather in a building. When moisture or water accumulates indoors, mold growth often will occur, particularly if the moisture problem remains uncorrected. While it is impossible to eliminate all molds and mold spores, controlling moisture can control indoor mold growth. All molds share the characteristic of being able to grow without sunlight; mold needs only a viable seed (spore), a nutrient source, moisture and the right temperature to proliferate.

Molds gradually damage building materials and furnishings. If left unchecked, mold can eventually cause structural damage to a wood framed building, weakening floors and walls as it feeds on moist wooden structural members. If you suspect that mold has damaged building integrity, consult a structural engineer or other professional with the appropriate expertise.

Mold contamination in the indoor environment is a complex issue. While scientific understanding about health effects and growth factors is evolving, there is currently considerable scientific uncertainty. Acknowledging this uncertainty, Unger Construction's policy represents best practices as defined by ANSI/IIRC S520 published December 2015. There are no state or federal laws (OSHA, EPA, CDC, NIOSH) that specifically mandate how mold must be remediated. There are no consensus standards or laws about how much mold or what kind of mold is acceptable in a work place. Nevertheless, mold is a significant public health issue and Unger has adopted a health-protective precautionary view with respect to mold remediation that aligns with our Infection Control practices.

Remediation of mold refers to the process of removing contamination. In many cases it is necessary for the remediation process to include engineering controls, administrative controls and other protective measures to prevent or minimize potentially harmful exposures to workers and occupants. The objectives of any mold remediation project are:

1) Correct the underlying moisture problem
2) Effectively and safely remove fungal contaminated material, including the mold contaminants in settled dust
3) Control contaminants during remediation (protecting the remediators and building occupants)
4) Repair property damage and prevent future loss to building materials and contents

Since important details may vary from one situation to another, each mold problem can be uniquely complex. The ability to evaluate and respond to the many issues involved can also vary significantly. Considerable degrees of judgment are necessary to determine how to best remediate a specific mold problem. Hence, this program allows considerable flexibility in determining how to respond to mold problems.

<u>Health Effects of Mold</u>

Currently, there are no federal standards or recommendations, (e.g. OSHA, CDC, NIOSH, EPA) for airborne concentrations of mold or mold spores. Scientific research on the relationship between mold exposures and health

effects is ongoing. Mold contamination of the indoor environment has been linked to discomfort and health problems including allergy reactions, asthma symptoms, irritant effects, respiratory problems, and a variety of other non-specific health complaints.

Most typical indoor air exposures to mold do not present a risk of adverse health effects. However, molds can cause adverse effects by producing allergens (substances that can cause allergic reactions). Potential health concerns are important reasons to prevent mold growth and to remediate existing problem areas. The onset of allergic reactions to mold can be either immediate or delayed. Allergic responses include hay fever-type symptoms such as runny nose and red eyes. Molds may cause localized skin or mucosal infections but in general, do not cause systemic infections in humans, except for persons with impaired immunity or those taking immune suppressive drugs.

Molds can also cause asthma attacks in some individuals who are allergic to mold. In addition, exposure to mold can irritate the eyes, skin, nose and throat in certain individuals. Symptoms other than allergic and irritant types are not commonly reported as a result of inhaling mold in the indoor environment. Some specific species of mold produce mycotoxins under certain environmental conditions. Potential health effects from mycotoxins are the subject of ongoing scientific research and are beyond the scope of this document.

General Safety Precautions

Do not touch mold or moldy items with your bare hands. Do not get mold or mold spores in your eyes. Remove protective gear and wash hands before eating, drinking or smoking. Eating, drinking and using tobacco products and cosmetics where mold remediation is taking place should be avoided. Dead mold is still allergenic. Avoid breathing mold spores without the protection of an N-95 respirator.

Personal Protective Equipment (PPE)

Physical disturbance of moldy materials can produce high airborne levels of mold particles and contaminated dust. When handling moldy materials or working in the remediation area, people should be protected from being exposed to contaminants. After determining the scope of mold contamination, determine what personal protective equipment is required for performing mold remediation. If the remediation job disturbs mold and mold spores become airborne, then the risk of respiratory exposure increases. Actions that are likely to stir up mold include: breakup of moldy porous materials such as wallboard, invasive procedures used to examine or remediate mold growth in a wall cavity, actively stripping or peeling wallpaper to remove it and using fans to dry items. The primary function of PPE is to avoid inhaling mold and mold spores and to avoid mold contact with the skin or eyes. The following sections discuss the different types of PPE that can be used during remediation activities. Unger Construction employees shall be provided PPE at no cost to the employee. Unger Construction will provide protection against contact with skin (dermal) and respiratory protection for our employees entering a containment area where mold remediation is being performed. The selection of PPE depends on the anticipated exposure and activities to be completed.

Gloves

Nitrile gloves are required to protect the skin from contact with mold. Cut resistant gloves will be required for much of the remediation activity therefore workers will often times be wearing dual glove protection. Inner gloves, such as nitrile to protect against mold exposure with an outer glove such as Kevlar to protect against cuts or abrasions. Some cleaning solutions and other mold remediation chemical treatments are potentially irritating. Gloves that extend to the middle of the forearm (well past the wrist) are recommended. The glove material should be selected based on the safety data sheet (SDS). If you are using a mild detergent or plain water, ordinary household rubber gloves may be used.

Eyes

Safety glasses alone do not provide adequate protection from mold spores. To protect your eyes, use non-vented goggles. Goggles must be designed to prevent the entry of dust and small particles. Wearing dual protection such as

safety glasses under a face shield is acceptable for moderate remediation projects. Full face respirators and powered air purifiers have built in eye protection therefore don't require safety glasses be worn underneath them.

Skin (*Protective Clothing)*

While conducting building inspections and remediation work, individuals may encounter mold as well as chemical and physical hazards. Consequently, appropriate personal protective clothing (i.e. reusable or disposable) is recommended for minimal remediation and is required for moderate and major remediation. Skin protection includes hoods and booties which are required for major remediation. Protective clothing is also used to minimize cross-contamination between work areas and clean areas, to prevent the transfer and spread of mold and other contaminants to street clothing, and to eliminate skin contact with mold and potential chemical exposures. For moderate remediation projects disposable paper overalls can be used. For major remediation projects mold-impervious disposable head and foot coverings and a body suit made of a breathable material, such as TYVEK®, should be used. Disposable PPE should be discarded after it is used. Used items should be placed into impermeable bags and be discarded as ordinary construction waste. Some mold remediation chemicals have requirements for protective clothing including aprons. Appropriate precautions and protective equipment should be selected based on the product manufacturer's warnings and recommendations.

Respiratory Protection

While there are no legal respiratory protection requirements specific to handling indoor mold, there are OSHA requirements that an employer must follow. Individuals using respirators must be trained, have medical clearance and must be fit-tested by a trained professional. In addition, the use of respirators must follow Unger Construction's respiratory protection policy. Respirators protect cleanup workers from inhaling airborne mold, contaminated dust and other particulates that are released during the remediation process. Respirators could be 2 strap N95, ½ face P100 (with organic vapor and acid cartridges) or full face P100 (with organic vapor and acid cartridges), air purified respirators (APR's), powered air purifiers (PAPR's). A full face piece respirator provides both respiratory and eye protection. Respirators are used to provide protection from mold and mold spores must be certified by the National Institute for Occupational Safety and Health (NIOSH). Before purchasing or wearing a respirator, Unger Construction employees and subcontractors must demonstrate they have proof of training, a current annual medical evaluation and a fit test. When using chemicals, check the safety data sheet for the permissible exposure level (PEL) and filter media type. Half face respirators cannot be used if concentrations exceed 10 times the PEL. The upper limit for full face respirators is 50 times the PEL. If the concentration will exceed 50 times the PEL PAPR's will be required they can be used up to 1,000 times the PEL.

Suggested PPE for Mold Remediation

Minimal	Moderate	Major
Gloves (nitrile, vinyl, etc.) Safety glasses under a face shield 2 strap -N95 filtering face piece respirator.	Gloves (nitrile, vinyl, etc.) Goggles –non vented. ½ Face-P100 respirator with organic vapor and acid gas filter media. Paper coveralls	Gloves (nitrile, vinyl, etc.) Full face respirator P100 with organic vapor and acid gas filter media. Tyvek clothing, head and foot coverings.

Communication

It is important to communicate with building occupants when mold problems are identified. Mold can be a very emotion packed topic and communication is key to helping maintain control of the situation. Open communication can foster cooperation and successful resolution of mold problems. Without it, problems can be made worse and solutions delayed by frustration, anxiety and distrust. To manage expectations and prevent unnecessary anxiety, it is essential to effectively deliver complete and accurate information to affected stakeholders about the nature of the problem.

When a mold problem is identified it is predictable that people may become distrustful, anxious and even openly hostile. This is especially true when employees feel that appropriate actions and safeguards are not being taken, that information has been withheld from them or that their concerns are not being taken seriously. Generally speaking an independent 3rd party (IH) should participate in the presentation to the clients' employees since they are better suited to handle the employees' health concerns.

Communication methods include meetings (include question and answer opportunities), memoranda, postings and flyers. The frequency of messages, methods of communication and degree of formality should be based on the scope of the project and the audiences' needs and interests (if in doubt, over-communicate). To ensure that information is consistent and accurate, project team members should identify a single point person to whom all requests for information about the remediation project are referred.

When remediation will disrupt normal operations, the project team should develop a communication strategy and make sure it is followed. In all such cases it is critical to be open, honest and direct. All findings regarding the problem should be fully and promptly shared. It is best to create an opportunity for discussion of these findings. Once remediation has begun the project team should continue to provide updates, progress and target completion dates.

The following are communication priorities:

1. Demonstrate that occupants' health and safety is of utmost concern and how potential risks are minimized
2. Supply appropriate details of project goals, findings, and activities
3. Provide a mechanism for open, ongoing two-way dialogue between the project team members and the affected groups or individuals

When mold problems are small and will likely be corrected through routine custodial practices, extensive communication efforts are often not necessary. However, due to the widespread attention given to mold, some means of communication should occur. By acknowledging the existence of even simple problems and explaining how they will be handled, project team members can demonstrate their commitment to protecting building occupants. Early, proactive communication can avert rumors and the perception that information has been concealed.

Documentation

Documentation and recordkeeping are important when investigating actual or potential mold, in developing a remediation plan, executing the plan and completing the remediation project. Remediation plans will include the following: scope of work, containment, pressure differentials, hazardous or regulated materials (lead or asbestos), safety and health provisions, cleaning details, disposal, post remediation evaluation, post remediation verification, containment removal and returning the remediation area to Condition 1

Investigations

Investigators should look for water intrusion, condensation, water stains, damage, odors and include the current conditions, the presence of moisture and the potential for mold. Correcting a mold problem requires understanding the extent of the problem and the underlying causes. In some cases, this is fairly simple such as when an obvious moisture source has affected only a limited area resulting in easily observable visible mold. However, this can be difficult when the source(s) of moisture, or the location(s) of the growth are not readily apparent. To achieve an effective solution, it is also imperative to understand the reason(s) for the moisture problem(s). Knowing the source of the moisture is vital to correcting it and preventing recurrence of the problem. Identifying the pathways the moisture may have taken can help locate hidden mold growth.

When moisture problems or contamination are extensive, an informed and thorough inspection of the affected and possibly other related building areas and systems might be needed (including elements of the building envelope). An

inventory should be made of all visibly moldy surfaces and materials that are water damaged. During the investigation floor plans should be used to determine the extent of the moisture migration identifying actual mold or potential mold, as well as areas that are wet or dry. In addition to the floor plans, the actuals walls of the building should be identified physically, typically colored tape, to clarify the boundaries of actual or potential mold growth as well as wet and dry areas.

During the investigation take pictures of everything; damaged, not damaged, (floors, walls, ceilings) conditions and placement of items within the space. Photos are very valuable in determining where items were and where they weren't making it easy to be replicated as conditions are returned to normal conditions after the remediation effort. Pictures enable the project team members to return components to their original positions, consider their use for this purpose when taking the photos (capture enough detail). Pictures also can be used to demonstrate that items were there in the first place or not there at all.

Heating, Ventilation and Air Conditioning (HVAC) Systems

HVAC system refers to the entire air distribution system from points where air enters the system to points of discharge. This may include return plenums (including ceiling plenums) and the mechanical room. The HVAC system is relevant to mold remediation because it may be the source of mold growth or the route of disseminating mold particles from one area to another. Every mold investigation should include an evaluation of the HVAC system. In particular, the entire HVAC system should be assessed for its role in the moisture problem(s). In some cases, mold may be growing on the sound-proofing or damping material used to line interior air-stream surfaces of air-conveyance ducts. If such lining (or any other non-smooth or porous air- stream surface) is colonized by mold growth, it should be removed, discarded and cleaned down to bare metal. The following HVAC system components should be inspected for growth, moisture and relevant defects, and cleaned or replaced as needed. Outdoor air intakes, Filters, Cooling coils (including evaporator fins), condensate pans, collectors and drains, humidifiers, air stream surfaces (baffles, dampers, include internal acoustical lining, fiberglass duct board, etc.), blowers, fan components and housings (supply, return and exhaust) and air distribution devices (registers, grilles, and diffusers).

Investigation Tools

Unger Construction and our 3rd party consultants will utilize a combination of moisture meters, borescopes and infrared cameras to determine the extent of moisture migration. Moisture meters and infrared cameras are noninvasive, borescopes are minimally invasive.

Moisture meters may be helpful for measuring the moisture content in a variety of building materials following water damage. They can also be used to monitor the process of drying damaged materials. These direct reading devices have a thin probe which can be inserted into the material to be tested or can be pressed directly against the surface of the material. Moisture meters can be used on materials such as carpet, wallboard, wood, brick and concrete. Moisture readings can be used to identify wet materials, dry materials and to track drying times. Moisture meters should be properly calibrated in accordance with manufacturers' specifications. Unger Construction utilizes the Delmhorst model DB-2100 moisture meter as our standard inspection tool. This tool is self-calibrating and is considered an industry standard, the use of other moisture meters is discouraged.

A borescope is a hand-held tool that allows users to see potential mold problems inside walls, ceiling plenums, crawl spaces and other tight areas. It consists of a video camera on the end of a flexible probe. Minor drilling or cutting of dry wall is required. Borescopes can reduce the amount of "hidden mold" by enabling viewing into spaces that are normally enclosed, reducing the surprises once the remediation effort is underway. Borescopes can be rented or purchased Unger Construction typically uses Extech, Milwaukee and or Dewalt borescopes.

Infrared (IR) cameras and thermometers are used to detect surface temperature differences which are indicative of moisture intrusion. Infrared cameras are useful in providing images that confirm or exclude potential mold growth areas. They can be used to measure roughly 10 foot by 10 foot sections quickly. Infrared cameras can save time by inspecting

areas that are difficult to access from a safe remote distance. They can quickly rule an area in or out for further inspection. Suspect areas should be verified by using a moisture meter. Infrared cameras are expensive, delicate instruments that require specialized training to efficiently operate them. Unger Construction does not own an infrared camera as these cameras are typically owned by the 3rd party consultant.

Investigation Techniques

Investigation techniques can be used to both determine the extent of a mold problem as well as determine if the remediation efforts have been successful, in essence before and after testing. Investigation techniques include sensory approach, moisture testing and sampling.

Sensory Approach

The sensory approach should be used to evaluate all mold remediation efforts, from the most routine "minimal" problems to "major" problems. The sensory approach involves using senses of sight and smell to determine the presence or absence of conditions that support mold growth. One very important indicator of mold removal effectiveness is the overall cleanliness of the work site after job completion. The presence of any remaining visible mold colonies indicates that cleaning and restoration was not adequate. Moreover, the presence of dirt, moisture, debris, and dust should not be tolerated in remediated areas after project completion. Methods to document a sensory evaluation include, photographs, white glove/black glove inspection for dust and confirmation by an independent third party. A white glove/black glove inspection involves allowing suspended matter time to settle, then wiping a finger over all or representative (previously determined) surfaces to demonstrate general cleanliness.

Combined with evidence that effective methods for removing mold contaminants were used and moisture problems were addressed, the sensory approach offers a practical and common sense option for evaluating whether remediation goals have been met. Sensory criteria should include, at a minimum, that there is no visible mold growth, negligible dust, no moldy odors and no apparent dampness.

Moisture Testing

Moisture meters and infrared cameras are used in combination to determine the extent of the initial moisture, the current moisture content of materials and to track drying times. Moisture meters are used to verify that adequate drying has occurred before the replacement of damaged materials, refinishing, installation of surface coverings or other re-construction efforts. Additionally, they can be used during post corrective actions and subsequent water testing before "close up" that the corrective measures have truly resolved and are controlling the original moisture issue.

When verifying acceptable moisture levels it is preferable to compare moisture measurements to published acceptable moisture content values for a particular material. The data sheet from the Delmhorst DB-2100 moisture meter will be used as reference and to make dry – not dry decisions. To calibrate the DB-2100 simultaneously press the watermark and the checkmark buttons. The display should read 12. If any other number appears replace the batteries and repeat the calibration test. Any number other than 12 indicates the instrument is not calibrated. Once calibrated use the star button to select the material being tested 1 (wood), 3 (gypsum). This instrument has 3 LEDs green = dry, yellow = likely to dry within 48 hours, red = won't dry in 48 hours. Investigate floor to ceiling on each floor of the building. Start at the lowest level, determine the width of the exposure by measuring horizontally at approximately 1 foot intervals. Continue measuring until you have 5 consecutive "dry" readings. Return to the last non-dry reading place tape on the wall 18-24 inches past the non-dry reading to indicate the horizontal boundary. Take photographs of known dry as well as known wet areas to clearly delineate the boundary. In addition to taping the floors, walls, ceiling make sketches or update a floor plan. To determine the height of the exposure use the same technique, making vertical measurements in approximately 1 foot intervals.

It is crucial to remember if the moisture problem has impacted closed spaces and cavities, then extent of mold growth might be greater than what is visible from within occupied spaces. In such cases destructive techniques may be used

carefully to access and inspect inside surfaces of floor, wall and ceiling cavities. Whenever there is information suggesting that additional contamination may be uncovered during remediation or investigation, increased contaminant control, personal protective measures should always be used. Plans should be made flexible to allow for any necessary revision of the project's scope, such as adjusting work practices and procedures if unforeseen contamination or other complications are encountered.

Hidden Mold

In some cases, indoor mold growth may not be obvious. It is possible that mold may be growing on hidden surfaces, such as the backside of dry wall, wallpaper, or paneling, the top of ceiling tiles, the underside of carpets and pads, etc. Possible locations of hidden mold can include pipe chases and utility tunnels (with leaking or condensing pipes), walls behind furniture (where condensation forms), condensate drain pans inside air handling units, porous thermal or acoustic liners inside ductwork, or roof materials above ceiling tiles (due to roof leaks or insufficient insulation). To locate potentially concealed mold, identify the pathways of water intrusion.

Some building materials, such as drywall with vinyl wallpaper over it or wood paneling, may act as vapor barriers, trapping moisture underneath their surfaces and thereby providing a moist environment where mold can grow. You may suspect hidden mold if a building smells moldy and you cannot see the source or if you know there has been water damage and building occupants are reporting health problems.

Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth—make sure to use PPE. For example, removal of wallpaper can lead to a massive release of spores from mold growing on the underside of the paper.

Sampling or Testing for Mold

Is sampling needed? In most cases, if visible mold growth is present sampling is unnecessary. Because mold contamination is not always visible, mold testing can serve an important and necessary role in evaluating remediation when it is done is scientific manner. However, before making the decision to use mold testing, the project team should familiarize themselves with the limitations, uncertainties and nuances of sampling to determine if testing will add value. It is important to remember that the results of sampling may have limited use or application. For someone without experience, sampling results will be difficult to interpret, experience in interpretation of results is essential most clients will lack that expertise (this is not an indictment of the client, but a simple reality). Sample results can vary dramatically depending on the time and location of the samples and often times many samples are needed to account for this variability. Since a large number of samples are necessary, the cost of mold testing can be considerable. Sampling can also be used to assess the possible spread of contaminants from a containment zone to adjacent areas during or after remediation. In cases involving major contamination, sampling has been used for post-remediation clearance.

Currently, there are no widely accepted testing protocols for mold, although a wide number of sampling methods exist. Sampling can include surface wipes, bulk samples and or several types of airborne techniques. Sampling should be done only after developing a sampling plan that includes a confirmable theory regarding suspected mold sources, routes of exposure and how the data will be utilized or interpreted. Since no EPA, State, Federal or other threshold limits have been set for mold, sampling cannot be used to check a building's compliance. There are a number of limitations to mold testing after a remediation project mold testing cannot answer questions such as "is there a safe level of mold" or "is the kind of mold present more harmful than others."

Unger Construction recommends that mold testing only be done if the results can adequately answer a question with acceptable certainty. Generally speaking, Unger Construction will utilize airborne (total mold – viable and non-viable) sampling to determine pre- and post-remediation conditions. In essence, have remediation efforts have been effective? After remediation the types and concentrations of mold in indoor air samples should be similar to what is found in the local outdoor air. Surface sampling may also be useful in order to determine if an area has been adequately cleaned or remediated. Surface samples will use the comparison method, remediation areas compared to unaffected areas.

When the decision has been made to sample the sampling for mold should be conducted by professionals with specific experience in designing mold sampling protocols, sampling methods, and interpretation of results. Sample analysis should follow analytical methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH). When utilizing airborne sampling, a sample shall be taken outdoors before indoor sampling and once indoor sampling is complete another outdoor sample shall be taken.

Data Interpretation

As discussed before, there are no widely agreed upon standards for acceptable levels of mold. Data is compared to the concentrations and diversity of molds present in the remediated area to the outdoor and unaffected indoor area air levels. The following general principles should be used when interpreting comparison sampling results:

- Comparison is only valid between samples taken at similar times on the same day and using the same sampling method. (e.g. flow rate, duration, culture medium, etc.)
- Some variation in the total mold levels and the presence or absence of a few types from one sample to the next is expected.
- Air sampling for mold provides information only for the moment in time in which the sampling occurred, much like a snapshot.
- Where relevant, indoor areas should be sampled and compared when building operations are similar, such as ventilation, open windows, cleaning and occupant activity level prior to and during sampling, and weather conditions.

The following suggests acceptable mold levels: 1) Total concentrations of mold (number of colony forming units and/or total spores detected per unit volume of air) in indoor samples should be similar to, or lower than outdoor and unaffected indoor area samples, 2) Indoor samples consistently contain types of mold present in the outdoor and unaffected indoor area samples, 3) Indoor samples are not dominated by types of mold (as a percentage of the total amount) unless the same types also dominate the comparable outdoor and unaffected indoor area samples.

Determining the Extent of the Mold Problem

The table below presents subjective criteria to help characterize the scale of mold contamination. Three categories minimal, moderate and major are used throughout this document to characterize the complexity of the contamination problem and the potential for exposure of building occupants. Persons responsible for planning the remediation should review and discuss the three criteria below (amount of mold growth, degree of contamination, and potential for releasing contaminants) to determine which category best describes the problem. Degree of contamination takes into account the density of the mold growth and the type of materials (porous, non-porous, semi-porous) supporting the growth. The potential for hidden mold growth should also be considered. Potential for releasing contaminants refers to the amount of disturbance necessary to clean or remove the contaminated material. Large amounts of disturbance or force can lead to the release of large numbers of mold spores.

Suggested Criteria for Determining Extent of Mold Problem

	Minimal	Moderate	Major
Degree of contamination	Visible growth is scattered small colonies. Growth on easy to access, non-porous surfaces.	Visible growth on porous or semi-porous materials is light & spotty. Non-porous materials are 50% covered with mold colonies. Possible hidden contamination.	Heavy distribution of visible mold on any type of surface. Likely hidden contamination. Contamination may be well established (long-term water problem).
Potential for release of contaminants	Surfaces can be easily cleaned in place. Small items can be easily removed and bagged.	Larger items need to be removed. Cleaning requires average force (ex. Scrubbing)	Aggressive force needed to clean or remove contaminated surfaces.

Remediation Goals

Clear and achievable goals should be set during remediation planning. All parties involved in the remediation project should understand and agree upon the goals. The ideal remediation goal is to restore the building to conditions in which occupants are free from health complaints or discomfort. It is, however, extremely difficult to achieve and maintain such a level of satisfaction given the many agents and conditions that can contribute to real and perceived indoor air quality problems and complaints. Some may demand that the goal should be a building free of all molds, but this is not possible or practical since spores will always be detectable in settled dust and in the air.

A reasonable remediation goal is to restore the building to normal conditions, reflected by: a lack of visible mold growth; a lack of mold odors and appropriate control of moisture. Another goal is to confirm, through testing, that the types and amounts of mold particles in the air or settled dust are similar in type and amount to what is present in unaffected and outdoor areas.

Setting evaluation criteria involves determining ahead of time how much contamination may remain after remediation is complete -- in other words, deciding what indicators or measurable results will be considered evidence of an acceptable outcome or “clearance.” These criteria need to be set before remediation work begins. Setting clearance levels too low will impractically increase costs without additional practical benefit. Instead, the criteria should be selected to show, in combination with other evidence and information about the remediation activities, that the remediated area was acceptably clean and dry at the time when the job was finished and that conditions that allowed mold growth were corrected. When using numerical criteria for clearance, it may be necessary to set material- and test method-specific criteria for interpreting testing results. This must be determined before the remediation work is begun and should ideally be understood and accepted by all key stakeholders.

Once goals for the remediation have been determined, evaluation criteria and methods can be selected. For “minimal” contamination cleaned by routine housekeeping, a sensory inspection alone should be adequate to judge project completion. When “moderate” or “major” contamination is present or health concerns have elevated the importance of the issue, a more thorough evaluation and communication of findings are required.

All of the remediation goals shall be captured and documented in the remediation plan. The remediation plan shall include the associated action plans (means, methods) for each remediation goal as well as the manner in which the decision will be determined that the goals have actually been achieved or that they have not yet been achieved and remediation efforts need to continue. Documenting the goals in the remediation plan is critical to successful project close out and returning the space to Condition 1.

Remediation Tools, Techniques and Equipment

Administrative Controls

For both health and practical reasons, administrative controls should be considered for any mold remediation project. Administrative controls are actions to protect building occupants by adjusting tasks and activities in ways that minimize exposure. Common examples include removing or relocating occupants and scheduling work during evening, or weekend hours. Practical and logistical considerations may also make it necessary to temporarily prohibit occupants from entering the work zone and possibly adjacent areas depending upon the nature and duration of the anticipated remediation project. For example, it is prudent to relocate occupants from areas adjacent to the mold remediation work area until it is verified that the work area is under appropriate containment (such as following measurements and visual observation of negative pressure relationships between the work area and adjacent occupied areas). It is important to clarify it is not necessary evacuate the entire building. Mold concerns can be remediated while utilizing engineering controls of the affected areas, while maintaining normal operations in the rest of the building.

Moisture Meters

Moisture meters measure/monitor moisture levels in building materials and may be helpful for measuring the moisture content in a variety of building materials following water damage. They also can be used to monitor the progress of drying damaged materials. These direct reading devices have a thin probe that is inserted into the material to be tested or pressed directly against the surface of the material. Moisture meters can be used on materials such as carpet, wallboard, wood, brick and concrete.

Drying Systems

Removing wet materials significantly improves the drying time. Generally speaking, Unger Construction will remove the bottom 12-18 inches of the drywall to expose the interior wall surface and bottom track to the drying systems. Drying systems, air movers and axial fans are the primary means to dry out a moisture intrusion event. When used in the initial response to an intrusion event they can be used to dry the area. If mold is already present care must be taken to prevent the spread of contamination. Air should be routed and vented to the exterior of the building. Infection control barriers and negative pressure systems should be used to minimize potential contamination.

Air movers are the most common equipment used they use a squirrel cage fan directed through a snout. Air movers create laminar air flow to promote evaporation. For porous materials at least one air mover should be utilized for every 300 square feet. For non-porous and semi-porous materials, at least one air mover should be utilized for every 500 square feet. When multiple air movers are used they outlet of each air mover should be oriented in roughly the same direction to achieve circulatory flow. For best results, aim the outlet at the wall in a 15-45 degree angle. The materials will dry based on the evaporation rate moisture is removed from the surface and from within the material at a fixed rate adding more or faster fans do not necessarily yield faster drying times. Generally speaking, the fans rated between 400-600 feet per minute are acceptable. Adjustments of the fans should be made throughout the drying process. Dehumidifiers can be used in conjunction with drying systems or separate, depending on the size of the area.

Drywall, carpet and insulation are difficult, if not impossible, to dry within 48 hours and therefore Unger Construction chooses to replace these materials. Our experience has found that this is the most expeditious method and the least costly to return the area to Condition 1. An additional benefit is complete confidence that mold will not surface at a later date.

Dehumidification

Dehumidifiers remove moisture from air by the process of condensation. Dehumidification involves the cooling of air below its dew point which causes the moisture to condense. Most dehumidifiers are rated for water removal in pints per day. The size and number of dehumidifiers will depend on the size of the affected area. When combined with extraction and air movers dehumidifiers can significantly decrease humidity, thereby speeding up the drying time. Air movers significantly increase the rate of evaporation from wet surfaces adding to the areas humidity. When using dehumidifiers ensure they have sufficient performance and capacity for each area in which they are used. Reservoirs of dehumidifiers shall be emptied at the end of each shift to ensure they do not overflow and re-contribute to the water load. Extracted water shall be disposed of in accordance with applicable laws and regulations.

Moisture Control

The presence of excess moisture is the primary underlying cause of indoor mold growth. Identifying and correcting sources of excess moisture is vital to resolving mold problems and preventing their reoccurrence. Understanding where excess moisture is located, along with what is causing the moisture and how it is entering the building, can help assess the likelihood of finding future mold growth. The completion of a remediation job should include evaluation of steps taken to correct moisture problems and prevent their return.

If a catastrophic water problem occurs (e.g. broken pipes, drain backup) it is essential to quickly correct the water source and to begin drying wet materials before mold growth can occur or spread. Building materials should be dried rapidly, ideally in less than 48 hours and preferably less than 24 hours, to a moisture content that does not support mold growth. Prior to drying, check that there is no visible mold growth. Restorative drying methods can pressurize materials (such as wall cavities) allowing mold particles to spread to uncontaminated areas. As a precaution, fans and other devices that create airflow should no longer be used once visible mold appears and drying should then proceed under more controlled conditions to avoid dispersing mold particles.

During the mold remediation project, it is necessary to control the use of water. For example, cleaning techniques should use water-based solutions sparingly and must include rapid drying practice following the cleaning steps. Power washing should be used as a last resort and only on non-porous materials or concrete (cementitious materials) if the material can be dried quickly. Power washing should not be performed if vulnerable material, such as wallboard and sheet rock, might get wet.

HVAC System Filter

High-quality filters must be used in a HVAC system during remediation because conventional HVAC filters are typically not effective in filtering particles the size of mold spores. Consult an engineer for the appropriate filter efficiency for your specific HVAC system and consider upgrading your filters as necessary. A filter with a minimum efficiency of 50 to 60% or a rating of MERV 8, as determined by Test Standard 52.2 of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, may be appropriate. Remember to change filters as appropriate, especially following any remediation activities. Remove filters in a manner that minimizes the reentry of mold and other toxic substances into the workplace. Remediators will wear appropriate PPE while performing this task.

Chemicals, Antimicrobials, Biocides, Encapsulates, Sealants

Source removal of mold contamination should always be the primary means of remediation. With that said, there are a variety of chemical products available for mold remediation. Antimicrobials should not be used as an alternative to physical removal and conventional cleaning procedures. Some antimicrobials are labeled for both low odor and low volatile organic compounds (VOC's). Coatings should not be used as sealants or encapsulates to contain or cover active, viable mold growth. Coatings should only be applied to surfaces that have been properly cleaned and conditions verified as returned to Condition 1. Coatings and encapsulates are short term measures only it is likely there would be a future occurrence. Refraining from making statements to the client about the effectiveness of these coatings Unger

Construction cannot warranty these products. Using antimicrobials, fungicidal coatings, mold resistant coatings or sealants as a substitute for proper source removal is discouraged. However, there may be specific instances where judgement dictates they are used. If antimicrobials, fungicidal coatings, mold resistant coatings or sealants are used they must be applied according to regulations and label directions. When Condition 3 situations exist that cannot be physically removed, it may be necessary to use encapsulates or sealants. Clients should clearly understand that these methods have limited effectiveness and could result in additional remediation work at a later date. Without removal the material could deteriorate and require long-term management. Encapsulates and sealants are temporary measures and is not a solution to the problem. Clients should understand that utilizing them will delay the remediation and likely increase the eventual cost and potential health exposures. Written direction and approval from the client are required. Indiscriminate antimicrobial or biocide application is discouraged. Biocide application is not considered an effective substitute for source removal. However, there may be specific instances where judgement dictates that biocides be applied. The purpose of mold remediation is to remove the mold to prevent human exposure and damage to building materials and furnishings. It is necessary to clean up mold contamination, not just to kill the mold. Dead mold is still allergenic, and some dead molds are potentially toxic. The use of a biocide is not recommended as a routine practice during mold remediation, although there may be instances where professional judgment may indicate its use. If a decision has been made to use biocides, always ventilate the area, outdoor air may need to be brought in with fans. Biocides are toxic to animals and humans, as well as to mold. Use appropriate PPE, read and follow label precautions. Some biocides are considered pesticides. Do not use biocides developed for use outdoors for mold remediation or for any other indoor situation. In California pesticide applicators must have an antimicrobial commercial license to apply pesticides. Standard household bleach is often used to clean and disinfect materials. Bleach should not be used on materials that will corrode. Bleach and many cleaning agents are rendered ineffective after reacting with microbial contamination or other organic soiling, they should be applied only to previously cleaned surfaces using clean applicators (buckets, mops, sponges, etc.) or dedicated equipment. Apply the solution with a damp cloth and leave it on for a period of time according to the manufacturer's direction (some disinfectants should be left on for 10 minutes or less, while bleach is usually left on for 30 minutes). After disinfecting, the remaining chemical residue should be damp wiped from the treated surface with clean water, and the material should be dried quickly. Working with bleach requires safety precautions. Never heat or combine bleach with ammonia- containing products, both will produce a toxic chlorine gas. Bleach should only be mixed with other chemicals if this is permitted on the label. Since bleach and most disinfectants and pesticides are volatile chemicals, they should only be applied when adequate ventilation and appropriate respiratory protection are used. When using bleach, PPE recommendations from the SDS shall be followed to the letter.

Temperature Extremes

Neither hot nor cold should be used as an alternative to cleaning and physical removal of mold contamination. In addition, significant amounts of moisture can be introduced into air from open flame heaters due to condensation. These types of heaters should be avoided in remediation areas.

Cross Contamination Control

Cross contamination control is achieved by engineering and administrative controls that ensure mold does not spread to non-contaminated areas via foot traffic, the movement of contaminated materials or equipment and through air movement.

Mold contaminated materials will be handled in a manner that minimizes the disturbance of fungal particles. To prevent the dispersion of particles beyond the remediation area, containment and special cleaning practices will be utilized. Containment includes physical barriers (rolled plastic or sheeting), pressure isolation (depressurization techniques via negative air pressure machines to maintain a pressure differential of 0.01- 0.03 inches water column, separation and protection of HVAC systems (separating the HVAC system from remediation areas and non-contaminated spaces), dust suppression methods (Kett saws, damp wiping and HEPA vacuum cleaning), decontamination procedures (ante rooms) and waste disposal (materials will be enclosed in plastic and removed from the building using the shortest direct route leading to the outside of the building).

Source Control

Mold contamination should be controlled as close to the source as practical. Use techniques that limit dust and aerosols. Work areas should be maintained free from dust as practical. Debris should be bagged immediately. (Touch it once protocol). Use razor knifes or Kett saws rather than tearing materials or using hammers and saws that don't have dust control. Set the cutting depth so that blades do not penetrate all the way through and damage hidden materials or utilities. Mold should be physically removed during remediation. Attempts to kill, encapsulate or inhibit mold are generally not adequate. Source control can be achieved by covering moldy surfaces with self-adhering plastic, plastic bags, encapsulates, sealants or physical barriers such as containment systems.

Containment Systems

The primary object of containment should be to prevent occupant and remediator exposure to mold. Containment systems are generally separated in 3 basic types. Source, limited and full scale containment. For all containment systems fire retardant materials with a minimum flame spread rating of 25 shall be used. The purpose of containment systems during remediation activities is to limit release of mold into the air and surroundings. In general, the size of the area helps determine the level of containment. However, a heavy growth of mold in a relatively small area could release more spores than a lighter growth of mold in a relatively large area. Choice of containment should be based on the results of the investigation and the remediation goals.

Pressure Isolation

Airflow should be from the non-contaminated areas (clean area) to the contaminated area. When using limited or full scale containment, HEPA filtered negative air machines are required to create pressure differential in relation to surrounding areas. Generally speaking the pressure in the remediation area will be between 0.01-0.03 inches of water less than the surrounding areas. Pressure differential can be measured or monitored by analog or digital manometers, smoke tubes or pencils, or visual inspection (plastic sheeting, billows inwards into the remediation area) Based on the scope of work the airflow exchange rate will need to be modified. For low dust producing tasks the airflow exchange rate should be 6 times per hour, for moderate dust producing the exchange rate is 8 times and for high dust producing the exchange rate is 12 times per hour.

Source Containment

Source containment is generally recommended for areas that are less than 25 square feet. The enclosure around the moldy area should consist of a single layer of 6-mil, fire-retardant polyethylene film (visqueen). The containment should have a slit entry and covering flap on the outside of the containment area. The polyethylene film can be affixed to floors and ceilings with tape.

Limited Containment

Limited containment is generally recommended for areas that are less than 100 square feet. The enclosure around the remediation area should consist of a single layer of 6-mil, fire-retardant polyethylene film (visqueen). The containment should have a slit entry and covering flap on the outside of the containment area. Zip poles or metal stud frame can be erected and polyethylene film attached to it. All supply and air vents, doors, chases and risers within the containment area must be sealed to minimize the migration of contaminants to other parts of the building. Removal of ceiling materials (tiles or drywall) may impact HVAC systems and the effectiveness of the containment system if the space above the ceiling is used as a return air plenum. In this case, containment should be installed from the floor to the ceiling deck. The containment area must be maintained under negative pressure relative to surrounding areas. This will ensure that contaminated air does not flow into adjacent areas. This can be done with a HEPA-filtered fan unit exhausted outside of the building. Prevent the remediation area from becoming positively pressurized. Cease all work if negative pressure has been lost, don't restart until appropriate pressure differential is re-established.

Full Containment

Full containment is recommended for the cleanup of mold contaminated surface areas greater than 100 square feet or in any major mold contamination situation. The enclosure around the remediation area should consist of a single layer of 6-mil, fire-retardant polyethylene film (visqueen) or flame rated corrugated plastic (Polygal). A decontamination chamber or ante room should be constructed for entry into and exit from the remediation area. The entryways to the

ante room from the outside and from the ante room to the main remediation area should consist of a slit entry with covering flaps on the outside surface of each slit entry. Removal of ceiling materials (tiles or drywall) may impact HVAC systems and the effectiveness of the containment system if the space above the ceiling is used as a return air plenum. In this case, containment should be installed from the floor to the ceiling deck. The containment area must be maintained under negative pressure relative to surrounding areas. This will ensure that contaminated air does not flow into adjacent areas. This can be done with a HEPA-filtered fan unit exhausted outside of the building. The remediation area must be prevented from becoming positively pressurized. Cease all work if negative pressure has been lost, don't restart until appropriate pressure differential is re-established.

Ante Room/Decontamination Chamber

Ante rooms or decontamination chambers are designed to prevent cross contamination by acting as a transition space between the remediation area and the surrounding clean areas. Ante rooms should be large enough to move materials into the remediation area without requiring both doors to be open at the same time. Opening both doors at the same time defeats the purpose of pressure isolation and will lead to cross contamination. The ante room shall have a waste container(s) and HEPA a vacuum to clean tools, materials and personnel as they exit the remediation space. Waste containers shall be large enough to place all contaminated PPE and protective clothing. Ante rooms shall be under negative pressure. The ante room shall be configured such that protective clothing (coverall, hoods, booties) shall be donned and doffed in this space. Contaminated materials (demolition debris) shall be bagged, wrapped or sealed before entering the ante room, from the remediation space. Before contaminated materials (demolition debris) are moved from the ante room the Condition 1 space all outer surfaces shall be HEPA vacuumed and damp wiped. Respirators should be worn until remediators are prepared to step outside the decontamination chamber and into the non-affected area. Respirators should be doffed and placed in a sealed bag while in the ante room. Tack mats shall be used to prevent tracking.

Removal of Contaminated Materials

Mold contaminated materials are <u>not</u> classified as hazardous waste and can be disposed in a sanitary landfill. Mold contaminated materials can be disposed of in normal landfills as construction waste, no special disposal provisions are required. Bag or wrap contaminated materials in heavy gauge plastic, preferably 6 mil thickness. It is important to package mold-contaminated materials in this fashion to minimize the dispersion of mold spores. Large items with heavy mold growth should be covered with polyethylene sheeting and sealed with duct tape before being removed from the remediation area. Sharp items capable of puncturing the wrap or plastic bags should be packaged in such a way to prevent them from penetrating the plastic bag or wrap. Mold-contaminated waste that is not immediately disposed of should be stored securely (e.g. in a covered and properly labeled waste container) located away from high traffic areas, entrances and fresh air intakes. Any hazardous materials removed must be kept separate from the non-hazardous waste, labeled appropriately and disposed of according to applicable rules and regulations. Some jobs may require the use of dust-tight chutes to move large quantities of debris to a dumpster strategically placed outside a window in the remediation area.

<u>Mold Remediation/Cleanup Methods</u>

Mold contaminated materials should be physically removed. Attempts to kill mold with a biocide or to encapsulate mold or inhibit mold growth using a sealant in lieu of removal,are not adequate. The chemicals and proteins which can cause a reaction in humans are present even in dead mold. Additionally, the purpose of mold remediation is to correct the moisture problem and to remove mold contaminated materials in a manner that will prevent human exposure and further damage to building materials and furnishings. A variety of cleanup methods are available for remediating damage to building materials and furnishings caused by moisture control problems and mold growth. The specific method or group of methods used will depend on the type of material affected. Some methods that may be used include the following:

Wet Vacuum

Wet vacuums are vacuum cleaners designed to collect water. They can be used to remove water from floors, carpets and hard surfaces where water has accumulated. They should not be used to vacuum porous materials such as gypsum

board. Wet vacuums should be used only on wet materials as spores may be exhausted into the indoor environment if insufficient liquid is present. The tanks, hoses and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may adhere to equipment surfaces.

Damp Wipe

Mold can generally be removed from nonporous surfaces by wiping or scrubbing with water and detergent. It is important to dry these surfaces quickly and thoroughly to discourage further mold growth. Instructions for cleaning surfaces as listed on product labels, should always be read and followed.

High-Efficiency Particulate Air (HEPA) Vacuum

HEPA vacuums are recommended for final cleanup of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums also are recommended for cleanup of dust that may have settled on surfaces. Care must be taken to assure that the filter is properly seated in the vacuum so that all the air passes through the filter. When changing the vacuum filter, remediators should wear respirators, appropriate personal protective clothing, gloves and eye protection to prevent exposure to any captured mold and other contaminants. The filter and contents of the HEPA vacuum must be disposed of in impermeable bags or containers in such a way as to prevent release of the debris.

Porous Materials

Porous materials that are wet and have mold growing on them may have to be discarded because molds can infiltrate porous substances and grow on or fill in empty spaces or crevices. This mold can be difficult or impossible to remove completely. Porous materials such as drywall, insulation and ceiling tiles should be removed and discarded. Drywall shall be cut back a minimum of 1 foot past the outermost moisture line. Semi-porous materials such as wood can be dried, cleaned and reused dependent upon their structural integrity.

Dry Times

Drying water damaged materials within 48 hours (of original exposure) can help avoid the need for remediation of mold growth because the moisture is removed before mold growth can start. Drying can be accelerated by using fans and dehumidifiers and heaters. Note: if mold growth is discovered the accelerated drying process must be stopped until containment and isolation systems can be installed.

Moisture Levels

Material	Green (Dry)	Yellow (Likely to dry in 48 hours)	Red (Unlikely to dry in 48 hours)
Wood	6-15%	15-17%	>17%
Drywall	0-.5%	0.5-1%	>1%
Concrete/masonry Using the 0-100 reference scale, not percentage of moisture	0-85	85-95	>95

The following guidelines should be followed for determining which materials can be cleaned and salvaged versus which should be discarded.

Mold Clean-Up Methods – Quick Reference

Material	Example	Type of Damage	Clean-up Method
Porous Materials	Paper, Carpet, Wallboard, Upholstery, Ceiling Tiles, Insulation	Visible mold growth	Bag or wrap in plastic; Discard
		No evidence of mold	Clean with HEPA vacuum, launder or other methods to lift and capture dust.
Semi-porous Materials	Solid wood, furniture, engineered wood or composite products, brick, cement, resilient floor coverings	Little surface growth; Structurally sound	HEPA vacuum, damp cleaning with soap and water, disinfecting, drying.
		Extensive fungal growth, Structurally compromised	Remove, bag in plastic and discard.
Non-porous materials	Metal, Ceramic Tile, Porcelain, Glass, Hard Plastic, Finished solid wood	Visible mold growth	HEPA vacuum, damp cleaning with detergent solution, and rapid drying.

Table 1 presents strategies to respond to water damage within 24-48 hours. These guidelines are designed to help avoid the need for remediation of mold growth by taking quick action before growth starts. If mold growth is found on the materials listed in refer to Table 2 for guidance on remediation.

Table 1: Water Damage – Cleanup and Mold Prevention	
Guidelines for Response to Clean Water Damage Within 48 Hours to Prevent Mold Growth* Note that mold growth will not always occur after 48 hours; this is only a guideline.	
Water Damaged Material[+]	Actions
Books and Papers	For non-valuable items, discard books and papers. Photocopy valuable/important items, discard originals Freeze (in frost-free freezer or meat locker) or freeze-dry until they can be properly reviewed and determinations made.
Carpet and backing – dry within 24-48 hours[δ]	Remove water with water extraction vacuum Reduce ambient humidity levels with humidifier Accelerate drying process with fans, dehumidifiers or heaters.
Ceiling tiles	Discard and replace
Cellulose insulation	Discard and replace
Concrete or cinder block surfaces	Remove water with water extraction vacuum Accelerate drying process with dehumidifiers, fans or heaters
Fiberglass insulation	Discard and replace
Hard surface, porous flooring[δ] (linoleum, ceramic tile, vinyl)	Vacuum or damp wipe with water and mild detergent and allow drying: scrub if necessary. Check to make sure under flooring is dry. Dry if needed.
Non-porous, hard surfaces (Plastics, metals)	Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	Remove water with extraction vacuum Accelerate drying process with dehumidifiers, fans or heaters. May be difficult to completely dry within 48 hrs. If the piece is valuable, you may wish to consult a restoration/water damage professional
Wallboard (drywall and gypsum board)	May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard and replace
Window drapes	Follow laundering or cleaning instructions recommended by manufacturer
Wood surfaces	Remove moisture immediately and use dehumidifiers, gentle heat and fans for drying (Use caution when applying heat to hardwood floors). Treated or finished wood surfaces may be cleaned with a mild detergent and clean water and allowed to dry. Wet paneling should be pried away from wall for drying.
*If mold growth has occurred or materials have been wet for more than 48 hours, consult Table 2.	

Table 2: Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water*			
Material or Furnishing Affected	Cleanup Methods[+]	Personal Protective Equipment	Containment
Minor – Total surface area affected less than 25 square feet.			
Books and Papers Carpet and Backing Concrete or Cinder block Hard Surface, porous Flooring (linoleum, ceramic tile, vinyl) Non-porous, hard surfaces (plastics, metals) Upholstered furniture and drapes Wallboard Wood surfaces	3 1,3 1,3 1,2,3 1,2,3 1,3 3 1,2,3	Minimum: N-95 two strap respirator and nitrile gloves.	Source
Moderate – Total surface area affected less than 100 square feet.			
Books and Papers Carpet and Backing Concrete or Cinder block Hard Surface, porous Flooring (linoleum, ceramic tile, vinyl) Non-porous, hard surfaces (plastics, metals) Upholstered furniture and drapes Wallboard Wood surfaces	3 1,3,4 1,3 1,2,3 1,2,3 1,3,4 3,4 1,2,3	Limited or Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Limited Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Major– Total surface area affected greater than 100 square feet or remediator exposure during remediation estimated to be significant			
Books and Papers Carpet and Backing Concrete or Cinder block Hard Surface, porous flooring(linoleum, ceramic tile, vinyl) Non-porous, hard surfaces (plastics, metals) Upholstered furniture and drapes Wallboard Wood surfaces	3 1,3,4 1,3 1,2,3,4 1,2,3 1,3,4 3,4 1,2,3,4	Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Full Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area

*See the recommend clean up methods on the next page.

Cleanup Methods for Table 2

A variety of mold cleanup methods are available for remediating damage to building materials and furnishings caused by moisture control problems and mold growth. The specific method or group of methods used will depend on the type of material affected, as presented in Table 2.

Method 1: Wet Vacuum
Wet vacuums are vacuum cleaners designed to collect water. They can be used to remove water from floors, carpets and hard surfaces where water has accumulated. They should not be used to vacuum porous materials, such as gypsum board. They should be used only when materials are still wet—wet vacuums may spread spores if sufficient liquid is not present. The tanks, hoses and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may stick to the surfaces.

Method 2: Damp Wipe
Whether dead or alive, mold is allergenic and some molds may be toxic. Mold can generally be removed from nonporous (hard) surfaces by wiping or scrubbing with water or water and detergent. It is important to dry these surfaces quickly and thoroughly to discourage further mold growth. Instructions for cleaning surfaces, as listed on product labels, should always be read and followed. Porous materials that are wet and have mold growing on them may have to be discarded. Since molds will infiltrate porous substances and grow on or fill in empty spaces or crevices, the mold can be difficult or impossible to remove completely.

Method 3: HEPA Vacuum
HEPA (High-Efficiency Particulate Air) vacuums are recommended for final cleanup of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums are also recommended for cleanup of dust that may have settled on surfaces outside the remediation area. Care must be taken to assure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, remediators should wear PPE to prevent exposure to the mold that has been captured. The filter and contents of the HEPA vacuum must be disposed of in well-sealed plastic bags.

Method 4: Discard — Remove Damaged Materials and Seal in Plastic Bags
Building materials and furnishings that are contaminated with mold growth and are not salvageable should be double-bagged using 6-mil polyethylene sheeting. These materials can then usually be discarded as ordinary construction waste. It is important to package mold contaminated materials in sealed bags before removal from the containment area to minimize the dispersion of mold spores throughout the building. Large items that have heavy mold growth should be covered with polyethylene sheeting and sealed with duct tape before they are removed from the containment area.

Cleaning of Remediation Equipment

Equipment used during remediation, such as respirators and protective clothing, may need careful cleaning depending on how much mold was released during cleaning. In the case of a “Minimal” mold contamination, tools and personal protective equipment can usually be adequately cleaned by damp wiping or washing with soap and water. With “Moderate” and “Major” mold contamination, all equipment should be HEPA vacuumed, damp wiped, bagged or wrapped before they are removed from the work area. This includes cleaning tools, negative air machines, bags containing waste, outer clothing, respirators, gloves, and goggles. Workers should wear at least an N-95 respirator when cleaning or replacing HEPA filtered equipment components. At the end of the removal effort all materials used for containment should be bagged and the area decontaminated as part of the final job site cleaning.

If hazardous materials such as lead or asbestos are also handled as part of the removal work, applicable regulatory work practices and procedures must be followed to clean remediation equipment.

Remediation Plan

Unger Construction's highest priority is to protect the health and safety of the building occupants and remediators. The remediation plan should cover the use of appropriate personal protective equipment (PPE). It also should include steps to carefully contain and remove moldy building materials in a manner that will prevent further contamination. The remediation plan may vary greatly depending on the size and complexity of the job and may require revision if circumstances change or new facts are discovered (such as hidden mold or an additional moisture source). It is a best practice to develop detailed remediation plan prior to starting any mold remediation project, especially when the problem is considered "major" or subcontractors are involved. The remediation plan should clearly define the responsibilities of all parties involved in the project and state the requirements for removal, salvage, cleaning and abatement of hazards.

After gaining a reasonable understanding about the extent of mold contamination, the source(s) of excess moisture and the type of damaged materials, project team members should determine the scope of remediation best suited to the problem. Remediation efforts will depend upon the ability of the material to absorb or adsorb moisture, whether or not the materials are porous, semi-porous or nonporous. In essence, the materials ability to trap and hold mold spores. In some cases, especially those involving large areas of contamination, the remediation plan may include temporary relocation of some or all of the building occupants.

Example Remediation Plan for Minimal Remediation

Remediation project plans should cover the following topics at a minimum:

1) identification of possible hazardous materials (such as lead and asbestos) in abatement areas
2) health and safety precautions
3) remediation of excess moisture (steps to permanently correct the water or moisture problem)
4) mold abatement practices and procedures
5) repair and re-construction
6) evaluation/determination of project completion

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Example Moderate and Major Remediation Plan

1. Identification of Hazardous Materials (Asbestos or Lead)
    a. Removal of regulated materials (Asbestos or Lead)

2. Investigation Techniques
    a. Sensory approach
    b. Moisture testing (Moisture probes, IR Cameras, Borescopes)
    c. Testing/sampling (Surface, air [viable or non-viable)

3. Data Interpretation

4. Determining the extent of the problem

5. Hidden Mold

6. Cross Contamination Control
    a. Administrative controls (relocating occupants and scheduling work during evening, or weekend hours.
    b. Containment
        i. (Source, Limited, Full)

7. HVAC systems

8. Removal of contaminated materials (waste disposal)

9. Remediation Goals

10. Communication Protocol (communication strategy within the project team and to building occupants)

11. Documentation
    a. (3rd party reports, investigation reports, pictures, floor plans, remediation plan, acceptance criteria)

12. Third Party participation (IH Consultant)

13. Remediation Tools, Techniques and Equipment

14. Post Remediation Verification (indicators considered evidence of an acceptable outcome or clearance)

15. Returning the Area to Condition 1

16. Relocation back into the remediated space

17. Budget

18. Staffing

19. Schedule

20. Contract terms

Post Remediation

Post remediation shall be conducted and formally documented to determine whether or not the remediation has been complete. It can include visual inspection, olfactory evaluation for malodors, tools and equipment such as infrared cameras, moisture meters and particle counters. These inspections shall be performed with client representatives and, when appropriate, 3rd party consultants. Once successful remediation has been confirmed in writing, the space can be brought back to like new (Condition 1). If significant inadequacies are revealed, proper remediation should be resumed before remediation activities continue.

Post Remediation Verification

1. The cause of the original problem (source of the water) has been resolved
2. No visible mold growth on any construction materials
3. Impacted materials have been removed and properly discarded
4. All construction materials are dry to industry standards
5. Indoor air quality is within acceptable levels
6. Verification is when the structure, systems and contents have been returned to Condition 1

Returning the space into Condition 1

Whenever occupants have been moved, anticipate questions about re- occupancy and safety after job completion. Post-remediation evaluation findings are necessary for making re-occupancy decisions. Communicating these findings is essential to provide peace of mind to the occupants. Implicit is the need to determine (in the planning phase) specific clearance indicators or criteria that will be used to evaluate the effectiveness of the remediation. It may be useful to include stakeholders in high profile or “major” contamination problems, since this can help anticipate questions and concerns that may need to be addressed and to manage their expectations. After re-occupation, occupants should be informed about the process for reporting any future concerns.